Amendments to the Claims:

1.   (Original) 1.   A data storage system including a cache comprising a variable number of levels, each level having a cache controller and a cache memory wherein means are provided for address mapping to be recorded and applied between each level of the cache.

2.   (Original) A data storage system as claimed in claim 1, wherein the means for address mapping are provided for a level between that level and the level above in the cache.

3.   (Original) A data storage system as claimed in claim 1, wherein the cache includes means for creating a new level in the cache above an existing level and means are also provided for tying an address mapping to the existing level.

4.   (Original) A data storage system as claimed in claim 1, wherein the address mapping between the levels of the cache corresponds to a point in time virtual copy operation which has been committed to the cache in electronic time.

5.   (Original) A data storage system as claimed in claim 4, wherein a new level is created in the cache when a point in time virtual copy operation is committed to the cache.

6.   (Original) A data storage system as claimed in claim 4, wherein a plurality of point in time virtual copy operations are tied to a single level provided the point in time virtual copy operations do not conflict with any intervening writes to the cache.

7.   (Original) A data storage system as claimed in claim 1, wherein the cache includes means for deleting a level of the cache including means for destaging data from the level to underlying storage devices.

8.   (Original) A data storage system as claimed in claim 1, wherein lower levels of the cache are destaged before upper levels and after a level is destaged, the address mapping recorded for a destaged level is applied to underlying storage devices.

9.   (Original) A data storage system as claimed in claim 1, wherein the data storage system also includes a processor and memory, and underlying data storage devices in the form of an array of storage devices having a plurality of data blocks organized on the storage devices in segments distributed across the storage devices, wherein when a data block in a segment stored on the storage devices in a first location is updated, the updated data block is assigned to a different segment, written to a new storage location and designated as a current data block, and the data block in the first location is designated as an old data block, and having a main directory, stored in memory, containing the locations on the storage devices of the current data blocks.

10.   (Currently Amended) A data storage system as claimed in claim 9 4, wherein the data storage system is in the form of a log structured array and the point in time virtual copy operation is a snapshot copy operation.

11.   (Original) A data storage system as claimed in claim 4, wherein the point in time virtual copy operation is a flash copy operation.

12.   (Original) A cache comprising high-speed memory, the cache having a variable number of levels, each level having a cache controller and a cache memory, wherein means are provided for address mapping to be recorded and applied between each level.

13.   (Original) A cache as claimed in claim 12, wherein the means for address mapping are provided for a level between that level and the level above in the cache.

14.   (Original) A cache as claimed in claim 12, wherein the cache includes means for creating a new level in the cache above an existing level and means are also provided for tying an address mapping to the existing level.

15.   (Original) A cache as claimed in claim 12, wherein the address mapping corresponds to a point in time virtual copy operation which has been committed to the cache in electronic time.

16.   (Original) A cache as claimed in claim 15, wherein a new level is created when a point in time virtual copy operation is committed to the cache.

17.   (Original) A cache as claimed in claim 15, wherein a plurality of point in time virtual copy operations are tied to a single level provided the point in time virtual copy operations do not conflict with any intervening writes.

18.   (Original) A cache as claimed in claim 12, wherein the cache includes means for deleting a level of the cache including means for destaging data from the level to an underlying storage system.

19.   (Original) A cache as claimed in claim 12, wherein lower levels of the cache are destaged before upper levels and after a level is destaged, the address mapping recorded for that level is applied to an underlying storage system.

20.   (Original) A cache as claimed in claim 15, wherein the point in time virtual copy operation is a snapshot copy operation.

21.   (Original) A cache as claimed in claim 15, wherein the point in time virtual copy operation is a flash copy operation.

22.   (Original) A method of data storage comprising reading and writing data to a cache having a variable number of levels, wherein the method includes recording and applying address mapping between each level of the cache.

23.   (Original) A method of data storage as claimed in claim 22, wherein the address mapping is provided for a level between that level and the level above in the cache.

24.   (Original) A method of data storage as claimed in claim 22, wherein the method includes creating a new level in the cache above an existing level and tying an address mapping to the existing level.

25.   (Original) A method of data storage as claimed in claim 22, wherein the address mapping between the levels of the cache corresponds to a point in time virtual copy operation which has been committed to the cache in electronic time.

26.   (Original) A method of data storage as claimed in claim 25, wherein the method includes creating a new level in the cache when a point in time virtual copy operation is committed to the cache.

27.   (Original) A method of data storage as claimed in claim 22, including the steps of: writing data to a first level of the cache until a point in time virtual copy operation is committed to the cache; recording the mapping defined by the point in time virtual copy operation; tying the record to the first level; creating a second level of the cache; writing subsequent writes to the second level of the cache.

28.   (Original) A method of data storage as claimed in claim 26, wherein a plurality of point in time virtual copy operations are tied to a single level provided the point in time virtual copy operations do not conflict with any intervening writes to the cache.

29.   (Original) A method of data storage as claimed in claim 25, wherein the point in time virtual copy operation is a snapshot copy operation.

30.   (Original) A method of data storage as claimed in claim 25, wherein the point in time virtual copy operation is a flash copy operation.

31.   (Original) A method of data storage as claimed in claim 22, including the steps of: receiving a read request in the cache; searching a first level of the cache for the read; applying the address mapping for the next level to the read request; searching the next level of the cache; continuing the search through subsequent levels of the cache; and terminating the search when the read is found.

32.   (Original) A method of data storage as claimed in claim 31, including the step of remapping a read request by applying all the address mappings of the levels of the cache to the read request and applying the remapped read request to an underlying storage system.

33.   (Original) A method of data storage as claimed in claim 22, wherein the method includes deleting a level of the cache including destaging data from the level to underlying storage devices.

34.   (Original) A method of data storage as claimed in claim 22, including the steps of: destaging data from the lowest level of the cache to an underlying storage system; applying the address mapping for the lowest level to the underlying storage system; deleting the lowest level of the cache.

35.   (Original) A method of data storage as claimed in claim 22, wherein the data storage is arranged as a log structured array storage subsystem including a write-back cache.

36.   (Original) A computer program product stored on a computer readable storage medium, comprising computer readable program code means for performing the steps of reading and writing data to a cache having a variable number of levels, recording and applying an address mapping between each level of the cache.